

## **DETAILED ACTION**

### ***Election/Restrictions***

Applicant's election without traverse of group I, claim 69, in the reply filed on 7/23/2009 is acknowledged.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 4, 18, 21, 40, 51, 66, and 69 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

With respect to claim 4 and 69, there is no support found in the specification of the limitation "the reflector is a photonic bandgap crystal" or "the photonic bandgap crystal is a volume diffractive grating."

With respect to claim 18, 51 and 66, there is no support found in the specification of the limitation "0.2 nm" and "0.01 nm."

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With respect to claim 40, there is no support found in the specification of the limitation “the sidemode suppression ratio in the light source is greater than -30dB.”

With respect to claim 40, there is no support found in the specification of the limitation “wherein the output beams of the first laser and the second laser have different polarizations.”

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 50 and 54 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 50 recites “the reflector is in ‘contract’ with a rear facet of the laser diode” which is conflict with the claim 1. Claim 1 recites "the reflector being in optical communication with the semiconductor diode laser to receive an output beam form the diode laser, such that a portion of the light in the output beam is reflected back into the laser by the reflector to stabilize one or more of the spatial beam quality and the spectral line width of the diode laser." Firstly, it's conflicting because the output of the diode laser (or laser diode) is emitted in front of the laser diode, not from the rear. Secondly, it is not clear how the reflector stabilizes one or more of the spatial beam quality and the spectral line width of the diode laser. It's further noted that the term “in contract’ should be corrected.

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Claim 54 recites "wherein the laser active medium is an active medium of a disk laser" which is conflicting with claim 1 because claim 1 recites "a semiconductor diode laser" which cannot be a disk laser.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 7, 9, 14-17, 20, 23-26, 28, 35, 37, 40-41, 43-47, 49-50, 58-61, 64-65 and 67 are being anticipated by Volodin et al. (US 20050018743).

Volodin discloses the claimed invention as follows:

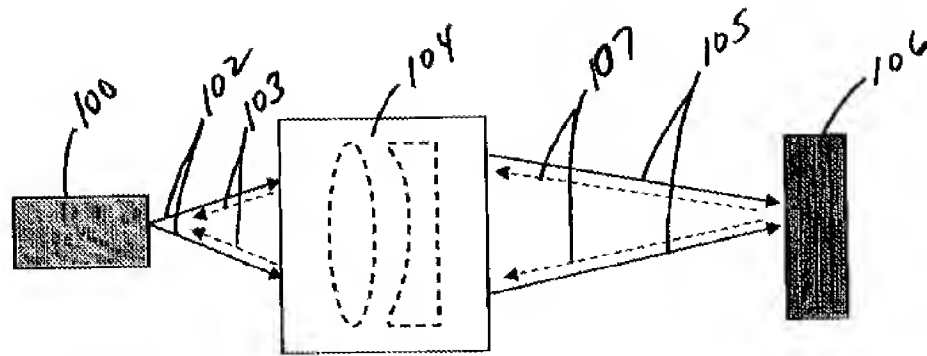


FIG. 1A

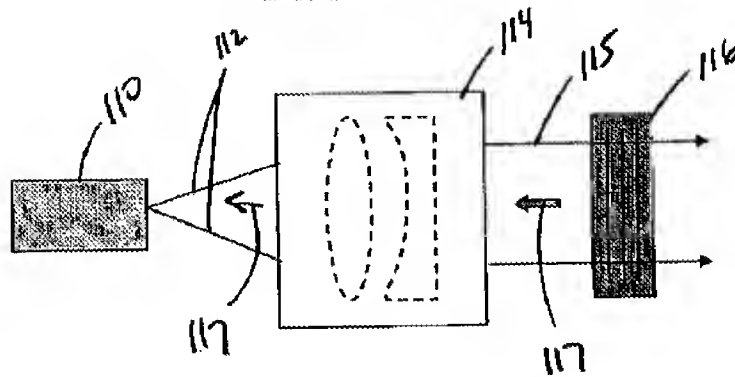


FIG. 1B

With respect to claim 1, Fig. 1 illustrates a light source comprising:

- a multi-spatial mode semiconductor diode laser 100; and
- a reflector 106 having a three-dimensional pattern of refractive index variations within the reflector, the reflector being in optical communication with the semiconductor diode laser to receive an output beam of the diode laser, such that a portion of the light in the output beam is reflected back into the laser by the reflector to stabilize one or more of the spatial beam quality and the spectral line width of the diode laser. Also see paragraph 7 for spatial multimode laser.

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With respect to claims 7, 9, and 58 the reflector 106/116 has a peak reflectivity that is greater than a reflectivity of an output facet of the laser diode in order to reflect the broader range of wavelengths back to the laser diode aperture (paragraph 78) and the reflectivity of the output facet is less than about 50% or less than about 3% (paragraph 57).

With respect to claims 14 and 65, Volodin discloses in claim 46 the reflector (VBG element) being configured to focus the light from the laser diode along a slow axis of the laser diode.

With respect to claims 15-16 and 20, Volodin discloses wherein the reflector is configured to enhance the gain of a desired lateral mode over the gain of other lateral modes to increase a brightness of the output beam/wherein the reflector is configured to enhance optical feedback to the diode laser in a desired optical mode relative to other optical modes (paragraph 65). It's noted that the desired optical mode is single mode.

With respect to claim 17, see paragraph 73.

With respect to claim 23, see paragraph 78 for mode locking.

With respect to claim 24, Volodin clearly shows in most of Figures the external cavity defined by the laser facet and the VBG reflector.

With respect to claim 25, Fig. 1A illustrates at least a lens 104 between the reflector 106 and the diode laser 100.

With respect to claim 26, see paragraph 53.

With respect to claim 28, see Figs. 3, 5, 6, and 8 for multiple diode lasers 141/151/171 aligned with respect to the reflector 146/156/176 such that a portion of the

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light emitted from each of the diode lasers is reflected back into the diode laser from which the light is emitted.

With respect to claims 35, 37, 67, Volodin further discloses in Figs. 18A and 18B a light source comprising:

- a first multi-spatial mode semiconductor diode laser LD1;

- a first reflector 288 having a three-dimensional pattern of refractive index variations within the reflector, the first reflector being in optical communication with the first semiconductor diode laser and aligned with an output beam of the first laser such that a portion of the output beam of the first laser is reflected back into the first laser by the first reflector;

- a second multi-spatial mode semiconductor diode laser LD2 (3,4 or n);

- a second reflector 288 having a three-dimensional pattern of refractive index variations within the reflector, the second reflector being in optical communication with the second semiconductor diode laser and aligned with an output beam of the second laser such that a portion of the output beam of the second laser is reflected back into the second laser by the second reflector; and

- a first beam combiner 282 arranged to combine the output beams of the first laser and the second laser.

It's noted that the VGB element 288 includes a plurality of VGB nodes as shown in the Fig. 8B. Each node is considered as a reflector. The multiplexer 282 is considered as the first beam combiner since it combines all beams from the first and second diode lasers LD1 and LD2.

With respect to claim 36, Fig. 18B illustrates at least three grating element 288. The last grating element close to the reflector 280 is considered as a first beam combiner. This beam combiner is external to cavities from by the first reflector and the first diode laser and the second diode and the second reflector.

With respect to claims 40-41 and 61, it is believed that since the diode lasers LD1 and LD2 provide different wavelengths ( $\lambda_1$ ,  $\lambda_2$ ), they also provide different polarizations.

With respect to claim 43, Volodin further discloses a third semiconductor diode laser (LD3);

a third reflector 288 having a three-dimensional pattern of refractive index variations within the reflector, the third reflector being in optical communication with the third semiconductor diode laser and aligned with an output beam of the third laser such that a portion of the output beam of the third laser is reflected back into the third laser by the third reflector; and

a second beam combiner 288 arranged to combine the output beams of the first laser and the third laser in parallel.

It's noted that the VBG element 288 includes a multiples grating elements. The last grating element (next to the retro-reflecting device 280) also combines all the laser beams from the first and the third laser in parallel.

With respect to claim 44, see paragraphs 49-50, 56, and 58...

With respect to claim 45, since the laser diodes are multimode lasers, it is considered as wide stripe emitter. Also see applicant's specification, in last paragraph of page 1.

With respect to claims 46 and 64, it is inherent that light reflected back to the laser diode by the VBG elements acts to discriminate undesired spectral mode.

With respect to claim 47, see Fig. 1 for the reflected light from the reflector 106/116. Other device such as lens 104 does not provide any feedback to the laser diode.

With respect to claim 48, as described above, the diode lasers 100/110 are multimode lasers by themselves.

With respect to claims 59 and 60, Volodin discloses in Figs. 3 and 5 the lasers 141 being arranged in an array on a single chip and in Figs. 6 and 8 the lasers 151 and 171 being arranged in multiple single-chip array, and wherein the arrays are stacked on top of each other.

Claims 1 and 4 are rejected under 35 U.S.C. 102(b) as being anticipated by Deng et al. (US 6704343). Deng discloses in Fig. 4 a light source comprising:

- a multi-spatial mode semiconductor diode laser 410-404; and

- a reflector 402 having a three-dimensional pattern of refractive index variations within the reflector, the reflector being in optical communication with the semiconductor diode laser to receive an output beam of the diode laser, such that a portion of the light in the output beam is reflected back into the laser by the reflector to stabilize one or more of the spatial beam quality and the spectral line width of the diode laser.



***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 52 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Volodin et al. (US 20050018743).

Volodin discloses the claimed invention except for a laser active medium that absorbs at least a portion of the output beam and is pumped by the output beam wherein the active medium is a disk laser.

It would have been obvious to one skilled in the art at the time the invention was made to provide one of those active medium type as claimed because it's been known that disk laser needs an optical pump such as a laser beam source to output a different laser beam that has more practical wavelength range and more powerful in order to use for many applications.

*Communication Information*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phillip Nguyen whose telephone number is 571-272-1947. The examiner can normally be reached on 9:00 AM - 6:00 PM, Monday-Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, MINSUN HARVEY, can be reached on 571-272-1835. The fax phone number for the organization where this application or proceeding is assigned is **571-273-8300**.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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